

Policy, Research, and External Affairs

**WORKING PAPERS**

Financial Policy and Systems

Country Economics Department

The World Bank

April 1990

WPS 409

# **Financial Policy and Corporate Investment in Imperfect Capital Markets**

## **The Case of Korea**

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The vigorous expansion of corporate real investment in Korea in the 1980s despite high real interest rates owes much to the rapid growth of the stock market and its increasingly important role in supplying equity capital to the corporate sector.

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This paper — a product of the Financial Policy and Systems Division, Country Economics Department — is part of a larger effort in PRE to understand the role of capital markets in the growth and adjustment process of developing countries. Copies of this paper are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Maria Raggambi, room N9-041, extension 37657 (47 pages with tables).

Dailami's econometric findings support three conclusions about the relationship between corporate finance and real investment in Korea:

First, assuming that debt capital has been subsidized through both taxation and regulatory interest rate policy, corporations have drawn on the stock market to finance their marginal investment projects.

This reliance on new share issues as the marginal source of financial capital is consistent with the observed relationship between stock market price movements and corporate investment behavior. It also explains Dailami's inability to establish a statistically meaningful relationship between corporate investments and profits — which would have been the case had corporations funded their investments at the margin through retained earnings.

The marginal profitability of investment in Korea is high, or has been shifting upward. Otherwise it would be difficult to justify corporate reliance on relatively costly external equity as a marginal source of funds.

Second, the real aggregate stock market price, rather than the average  $q$ , or even the average rate of profit, is the preferred proxy for the theoretically appropriate — but unobserved — marginal  $q$  in explaining corporate investment behavior. The link between stock market and real economic activity has been particularly

evident in the 1980s, when rapid growth of the market has been accompanied by vigorous economic growth and a boom in corporate business investment.

Third, corporations in Korea have used low-cost debt to finance investments in financial assets as well as in physical and productive assets. These financial assets — liquid assets (cash, bank deposits, and government securities), other companies' shares, and accounts receivable — are known to account for relatively more (42.6 percent) of total corporate assets in Korea than in the United States (24.3 percent) or the United Kingdom (37.8 percent).

To the extent that external equity is the corporate sector's marginal source of funds, what is relevant in determining incentives for new investment is what determines the cost of equity (such as taxation of dividends and capital gains) plus the procedure for pricing new share issues.

Policy should cater increasingly to the requirement of developing equity markets, including measures to change the method of pricing new share issues from the prevailing par-value based system (or premiums thereof) to a system based on market forces. The existing par-value pricing procedure has evidently been an important factor behind the high cost of external equity capital in Korea and a potential source of speculation.

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I would like to thank Gerard Caprio, Marcelo Giugale and Patrick Honohan for helpful comments and suggestions, and Inbom Choi for expert research assistance.

## I. Introduction

Central to the effectiveness of financial policies geared towards promoting real business investment is the interaction between corporations' financing and investment decisions. The analysis of this interaction and its implications for the role of finance in real economy has long been debated in the field of both corporate finance and investment theory.<sup>1</sup> In the former, the debate has centered on the determinants of optimal capital structure in the capital market environment of industrialized countries where the existence of well developed securities markets for pricing of various debt and equity claims on corporate assets are taken for granted. Within this context, one important goal of research has been to modify the implications of the original Modigliani-Miller (1958) leverage irrelevance theorem, by taking explicit account of the influences of taxes and costs of bankruptcy [Kraus and Litzenberger (1973), Scott (1976), Kim (1978)], the agency cost of debt [Jensen and Meckling (1976)] and the potential loss of non-debt tax shields, such as depreciation allowances, [De Angelo and Masulis (1980)] on the determination of optimal financial leverage.<sup>2</sup> These studies have generally treated the corporate real investment decisions as exogenous and have focused on the financing aspects of corporate investment behavior. In contrast, there is the important strand of research on the neoclassical theory of private investment behavior which, either in its original context [Jorgenson (1963), Jorgenson and Hall (1971)] or in its modified cost of adjustment context [Lucas (1967),

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1 See, for example, Vickers (1970), Khu and Meyer (1963), Coen (1971), Dhrymes and Kurz (1967), and Ciccolo and Fromm (1979, 1980).

2 For recent empirical evidence on the simultaneous influence of these attributes on optimal corporate capital structure in the U.S., see Bradley, Jarrell and Kim (1984); Titman and Wessels (1988).

Gould (1968), Treadway (1969), Hayashi (1982)], assumes perfect capital markets and no uncertainty.<sup>3</sup> In this case, it follows that the firm's real investment policy is independent of how it is financed.

An important point of convergence between these separate areas of research activity on the theory of investment and finance is the recent advances in the theory of imperfect capital markets associated with, among others, Greenwald, Stiglitz and Weiss (1984), Myers and Majluf (1984), Bernanke and Gertler (1989), Fazzari, Hubbard and Petersen (1988); Grossman and Hart (1982). In an important departure from the traditional perfect capital market/full information assumptions underlying the Modigliani-Miller (1958) theorem--or the Jorgenson Investment model (1963)--this new strand of literature emphasizes the imperfections in capital markets arising not only from taxes, but also from asymmetry of information between users and suppliers of finance, and shows how these imperfections may create endogenous financing constraints preventing firms from investing in projects with positive net present values. This possibility arises because of the additional premium imposed on the supply of external finance, both debt and equity, when investors are less informed about the firm's investment opportunities or its asset characteristics than insiders, i.e. managers or stockholders. As a consequence, the firm cannot costlessly substitute external for internal funds in order to finance its desired levels of investment or dividend payments. The upshot is that firms' financing, dividend and investment decisions are interdependent, and the nature of this interdependence is influenced by the institutional and structural features of underlying capital market environment.

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3 For an extension of the neoclassical theory of investment to include uncertainty, see Lucas and Prescott (1971), Hartman (1972); Pindyck (1982); and Abel (1983).

Considering imperfections in capital markets, the experience of developing countries presents a germane ground. In almost all these countries capital markets are characterized by a high degree of segmentation, severe informational asymmetry, incomplete markets, weak prudential supervision, and above all by pervasive government interventions in the form of direct allocation of credit, official setting of interest rates and tight regulatory restrictions on companies' pricing and offerings of new equity share issues.<sup>4</sup> These imperfections are, to a large extent, structural, in the sense that they impose a higher degree of stringency on firms' financing and investment decisions than are implied by pure informational asymmetry presumed to exist in developed countries' capital markets. The reform of these structural imperfections is currently the focus of liberalization measures advocated by the international financial organizations [see, Cho (1986), Gelb and Honohan (1988), World Bank (1989)].

The objectives of this paper are two-fold: first, to develop an integrated approach towards the problem of optimal corporate real investment and finance in the context of a financial model of a developing economy characterized by credit rationing, a controlled banking sector, and an organized equity market; and second, to apply the model to the non-financial corporate sector of the Korean economy. Korea presents an interesting example for a number of reasons, including the government's traditionally active use of credit, interest rate and tax policy to stimulate investment; the existence of relatively well-developed and broad based equity markets; and the large size of the corporate sector, accounting for about 60 percent of total domestic capital formation [see Data Annex for background information on these features of the Korean economy]. In addition, the tax treatment of income from capital in Korea, particularly at the personal level, is very different

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<sup>4</sup> See, for example, Gelb (1989); Tybout (1984); Nabi (1989); Kim (1989); and the World Bank (1989).

from that in the United States,<sup>5</sup> thereby providing an opportunity to analyze the relationship between capital taxation, corporate finance and investment, issues which have so far been explored only in the context of industrialized countries with mature securities markets [Miller (1977), Poterba and Summers (1983, 1985); Bradley, Jarrell and Kim (1984)].

The remainder of the paper is organized as follows. In Section I we describe our theoretical model of companies' optimal investment and financing behavior, which is based on the familiar "Tobin's Q" approach to the theory of investment, but extended to incorporate some important tax and financial features of Korean economy. Specifically, in the model, there are three sources of funds: (i) retained earnings; (ii) debt capital; and (iii) external equity. Firms raise external equity in the form of both initial public offerings (IPO's)<sup>6</sup> and seasoned issues of stocks, while debt is placed only with the financial institutions including both domestic and foreign banks and non-bank financial institutions. There exists a well-functioning trading market in equity shares which price equity claims competitively, but the interest rate on bank loans is administratively set and is treated as a policy variable. Capital gains are exempt from personal taxes, but dividend incomes

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5 While there are important similarities in the prevailing tax codes in Korea and the United States in terms of corporate taxation, there are important differences in personal taxation. One such difference, for example, is the much lighter taxation of interest income relative to equity income in Korea than in the United States. Thanks to various exemptions, the effective maximum tax rate on interest income (including defense, education and residence taxes) in Korea is 18 percent compared to 28 percent in the United States (after the tax reform of 1986). But income from stocks is taxed much more heavily in Korea; although capital gains are not subject to personal taxation there, dividend income is taxed at a rate as high as 70 percent for wealthy individuals, once the defense and residence taxes are taken into account. See data Annex, Table A.1 for details.

6 The amount of capital raised through IPO's depends of course on the number of companies going public, and this has varied considerably during the past two decades. In 1987, for instance, there were 35 new listings and one delisting. See Securities Market in Korea, the Korea Securities Dealers Association, 1988, for details.

are subject to high marginal personal tax rates. Given these tax and financial constraints, the firm's optimal rate of real investment is derived as a function of "Tobin's marginal Q," (the ratio between the market's valuation of an incremental unit of capital to its cost of replacement), tax, and financial parameters characterizing the firm's marginal source of funds.

Section III discusses the estimation of the model, with annual data from 1963 to 1986. Using both capital market and balance sheet data, several measures of the valuation ratio are provided and their relevance and limitation for explaining corporate real investment behavior in the Korean economy are discussed. Finally, Section IV concludes the paper with a brief discussion of some relevant policy implications and lessons.

## II. Theoretical Framework

### 1. The Model

We begin our analysis with a description of the objectives that a firm's managers may pursue in formulating their investment and financing plans in the tax and financial environment of Korean economy.

Given the family-based structure of corporate ownership and control in Korea, it seems plausible to assume that managers act in the interest of existing shareholders and seek to maximize the value of equity subject to a set of constraints.<sup>7</sup> These constraints are set by technology, by imperfections in capital markets, by tax provisions, and by investors' required return on equity. The returns required by equity holders depend on returns on alternative investment opportunities, which in Korea (where capital markets have until quite recently been virtually closed), are taken to be yields on government bonds.

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<sup>7</sup> This assumption also applies to corporations with diffused shareholding bases under the conditions that managers have a share ownership stake in the firm [Jensen and Meckling (1976), or when the firm is leveraged with potential threat of bankruptcy [see Grossman and Hart (1982)]].



We, thus, posit,  $\rho = (1 - \tau_1)R$ , where  $\rho$  = required return on equity;  $R$  = average yield on government bonds, and  $\tau_1$  = effective personal tax rate on interest on government bonds. Similarly, letting  $m$  to be marginal personal tax rate on dividend income, and noting that capital gains in Korea are exempt from personal taxation, the firm's objective can be stated formally as:

$$\max E_0 = \int_0^{\infty} \exp(-\rho t) [(1-m)d(t) - v(t)] dt \quad (1)$$

where  $d(t)$  and  $v(t)$  denote, respectively, the firm's dividend payment and new share issues at time  $t$ , and  $E_0$  is the present value of future stream of after tax dividend payments net of new stock issues.

The firm solves the maximization problem (1), subject to a set of constraints. The first constraint stems from the legal requirement mandated by law [The Capital Market Promotion Act of 1968], which obliges companies to maintain a defined minimum stream of dividend payments regardless of their cash flow or tax consequences.<sup>8</sup> Thus, we have

$$d(t) \geq \bar{d} \quad \forall t \text{ time} \quad (2)$$

where  $\bar{d}$  is an exogenously given stream of dividend payments.

Likewise, we constrain new share issues to be non-negative or:

$$v(t) \geq 0 \quad \forall t \text{ time} \quad (3)$$

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<sup>8</sup> Note that such tax consequences are very severe in Korea where capital gains are not subject to personal taxation, while dividend income is taxed at a relatively high rate. In spite of that, companies have distributed a sizeable portion of their earnings as dividends to shareholders, averaging 28 percent for the corporate sector as a whole over the 1975-1986 period. The tax cost associated with this pay-out ratio, computed at an average dividend income tax rate of 58 percent, amounts to 16.2 percent of corporate earnings or about 3.4 percent of corporate fixed investment.

While there is no legal restriction on companies repurchasing their shares, the strong need for funds induced by robust expansion of corporate investment effectively precludes this option.

The third constraint refers to the firm's access to the official credit market, which is assumed to be limited. Specifically, we assume that banks are willing to lend only a fraction of each enterprise's new investment needs. This fraction is assumed to depend negatively on the company debt/capital ratio. A linear version of this restriction is expressed as,

$$b(t) \leq hP(t) I(t) + \beta_1 P(t) K(t) - \beta_2 B(t) \quad (4)$$

where  $b(t)$  is the maximum level of bank credit extended at time  $t$ ,  $B(t)$  is the stock of corporate debt outstanding,  $K(t)$  is the stock of real capital,  $I(t)$  is gross corporate real investment,  $P(t)$  is the price of capital goods, and  $h$ ,  $\beta_1$  and  $\beta_2$  are non-negative parameters of the underlying supply function of bank credit.

The fourth constraint refers to the equality between the use and sources of funds. The firm's sources of funds consist of three items: (a) after tax operating profits, net of interest payment but including depreciation allowances; (b) net borrowing; and (c) net proceeds from new share issues. On the use side, there are two main items: (a) payments of dividends and (b) expenditures on new capital goods including costs of installation and adjustment. Under these conditions, cash flow available for distribution to existing share holders at time  $t$  are given by

$$\begin{aligned} d(t) = & (1-\tau) [\pi(K(t)) - r B(t)] + b(t) - \beta B(t) + (1-u) v(t) \\ & - P(t) C(I(t), K(t)) - P(t)(1-\tau z(t))I(t) \end{aligned} \quad (5)$$

where  $\pi(\cdot)$  = before interest and tax profit, taken to be an increasing and concave function of  $K$ , i.e.  $\frac{\partial \pi}{\partial K} > 0$ ,  $\frac{\partial^2 \pi}{\partial K^2} \leq 0$ ,  $r$  = interest rate,  $\beta$  = amortization rate on debt,  $v$  = new share issues,  $u$  = the average cost, consisting of

both transaction and underpricing costs, per unit of capital raised through external equity issues,  $\tau$  = the corporate profit tax rate, and  $C(\cdot)$  = an adjustment-cost function assumed to be an increasing function of  $I$  and  $K$  and  $z$  = present value of depreciation allowance allowed for tax purposes on one unit of new investment.<sup>9</sup>

The cash flow constraint (5) is straightforward, although three features require comment. First, it is noted that interest payments are treated as tax deductible. This conforms to the prevailing tax regulation in many countries including Korea, where tax allowances are made for corporate interest payments. This, in effect, lowers the cost of borrowing and thus induces firms to substitute debt for equity financing. The limit to this process of substitution is determined either by some legal and institutional restraints on the debt finance available, or through consideration of various leverage-related costs such as bankruptcy costs, costs due to agency and asymmetrical information problems or a loss of non-debt tax shields [see De Angelo and Masulis (1980); Kim (1982); Ross (1985)]. Second, it is assumed that external equity financing is costly, and the cost is proportional to the gross proceeds from new share issuance, i.e.  $uv(t)$ .<sup>10</sup> Thus, the net proceeds from external equity capital are equal to  $(1-u)v$ , which is included in equation (5) as an addition to the firm's cash flows. Third, we have included a cost of adjustment item,  $C(I, K)$  in equation (5) to capture the additional installation

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9 Note that equation (5) excludes a term for depreciation allowances allowed for tax purposes on the existing level of capital. This term depends on past investment and has no influence on future investment [see Abel (1983); Summers (1981) for details.]

10 We recognize two types of costs here: (i) transaction costs involving underwriters' commissions and legal and other related expenses; and (ii) the indirect costs associated with the underpricing of new share issues due primarily to the "par value" method of setting the offer price at the par value. These indirect costs are very serious in Korea, where initial public offerings (IPOs) are traditionally priced at, or very close to, par value. IPO's however, account for only a small proportion of total equity capital raised externally; the dominant share comes from seasoned issuance of stocks offered to the existing shareholders in the form of rights issues.

expenses associated with the process of investment. The rationale is based on the models of Lucas (1967), Gould (1968) and Treadway (1969), where the cost of adjustment was introduced in the neoclassical theory of investment to obtain an explicit solution for the firm's optimal rate of investment. Furthermore, this cost function is assumed to depend positively on  $\frac{I}{K}$  and specifically to take the form:

$$C(I, K) = \alpha/2 \left( \frac{I}{K} - n(.) \right)^2 K \quad (6)$$

where  $\alpha \geq 0$  is a constant parameter, and  $n(.)$  is a function to be specified later and denotes the normal or long-term growth of fixed assets.

Two other constraints are the evolution of the firm's stocks of capital and debt as given by:

$$\dot{K}(t) = I(t) - \delta K(t) \quad (7)$$

$$\dot{B}(t) = b(t) - \beta B(t) \quad (8)$$

where  $\delta$  is the rate of depreciation of physical capital.

Equation (7) describes the familiar perpetual method of capital accumulation, wherein real capital increases at the rate of gross investment less depreciation due to obsolescence and wear and tear. The rate of depreciation is further taken as a constant fraction of existing capital stock. In equation (8) net flow of loans from the banking sector is defined as the difference between new loans contracted and the amortization payment on the existing loans where the rate of amortization is assumed to remain unchanged over time.

The maximization problem facing the firm, stated formally, is to choose  $b(t)$ ,  $I(t)$ , and  $v(t)$  to maximize the present value of its market equity, given by equation (1), subject to the constraints (2), (3), (4), (5), (7) and (8) and given initial conditions,  $B(0)$  and  $K(0)$ . This problem can be solved by means of standard control techniques. Thus, we treat  $b(t)$ ,  $I(t)$  and  $v(t)$  as control variables and  $B(t)$  and  $K(t)$  as state variables and formulate the current-value Hamiltonian,  $H$ , as,

$$H = (1-m) d-v + \lambda (I - \delta K) + \mu (b - \beta B) \quad (9)$$

where  $\lambda$  and  $\mu$  are the associated shadow prices of capital and debt, respectively.

Taking into account the constraints (2), (3) and (4) and substituting for  $d$  from equation (5) into (9), we define the Lagrangian  $L$  as:

$$\begin{aligned} L = & (1-m+\psi_2) [(1-\tau) (\pi(K)-rB) - \beta B + b - P(I(1-\tau z) + C(I, K))] \\ & + ((1-m+\psi_2) (1-u) + \psi_3 - 1) v \\ & + \psi_1 (hPI + \beta_1 PK - \beta_2 B - b) \end{aligned} \quad (10)$$

where  $\psi_1$ ,  $\psi_2$  and  $\psi_3$  are the Lagrangian multipliers associated with constraints (4), (2) and (3) respectively. The necessary conditions for an optimal solution are the following:

$$\dot{\lambda} = (\rho + \delta) \lambda - (1-m+\psi_2) \left[ (1-\tau) \frac{\partial \pi}{\partial K} + P \frac{\partial C}{\partial K} \right] - \psi_1 \beta_1 P \quad (11.a)$$

$$\dot{\mu} = (\rho + \beta) \mu + (1-m+\psi_2) [\beta + (1-\tau)r] + \beta_2 \psi_1 \quad (11.b)$$

$$\frac{\partial L}{\partial b} = (1-m+\psi_2) + \mu - \psi_1 = 0 \quad (11.c)$$

$$\frac{\partial L}{\partial I} = - (1-m+\psi_2) P \left( 1 - \tau z + \frac{\partial C}{\partial I} \right) + \lambda + \psi_1 h P = 0 \quad (11.d)$$

$$\frac{\partial L}{\partial u} = (1-m+\psi_2)(1-u) + \psi_3 - 1 = 0 \quad (11.e)$$

$$\psi_1 \geq 0 \quad (11.f)$$

$$\psi_2 (d-\bar{d}) = 0 \quad (11.g)$$

$$\psi_3 v = 0 \quad (11.h)$$

There are, a priori, several possible optimal paths or regimes corresponding to whether constraints (2), (3), and (4) are binding or not. To determine these optimal paths, we rely on the assumption that debt is cheaper than equity financing in Korea, which would imply that firms have the incentive to resort to the maximum level of borrowing possible. In this case,  $\psi_1 > 0$  and from equations (11.b) and (11.c) it follows that  $\psi_1 = \frac{\rho - (1-\tau)r}{\rho + \alpha + \beta_2}$ , which is the capitalized difference in the after tax cost of debt and equity per unit of debt capital, or the subsidy to the existing shareholders of the firm's having access to low cost debt. To derive formally the firm's optimal investment rule and its financing, we substitute for  $\psi_1$  into equations (11.d) and obtain,

$$(1-m+\psi_2) \left[ 1 + \alpha/2 \frac{\partial C}{\partial I} - \tau z - h \frac{\rho - (1-\tau)r}{\rho + \beta + \beta_2} \right] = q \quad (12)$$

where  $q = \frac{\lambda}{\rho}$  is the familiar "Tobin's marginal Q" defined as the ratio of the marginal value of an additional unit of capital (i.e. the shadow price of capital),  $\lambda$  to the price of capital goods,  $P$ . [Abel (1979), Chirinko (1987)].

Equation (12) describes the equilibrium condition for the firm's optimum level of real investment. It states that an optimizing firm will continue to invest until the marginal cost of an additional unit of investment is equal to the marginal value of that investment. The marginal cost of investment depends on the cost of the marginal source of funds as well as on the net

marginal costs of acquiring capital. The latter terms involve the sum of purchase and marginal adjustment costs less the tax savings from depreciation allowances on one unit of investment in fixed assets and less the leverage related benefits to the existing shareholders of the availability of low cost debt. The availability of low cost debt implies also that equity is the marginal source of financial capital to the firm; and in this respect there are two alternative optimal investment rules, depending on whether the firm finances its investment at the margin by resorting to retained earnings (i.e. internal equity), or by issuing new shares, (i.e. external equity). These alternatives correspond, formally, to whether ( $\psi_2 = 0$  and  $\psi_3 > 0$ ), which implies  $1 - m + \psi_2 = 1 - m$ ; or whether ( $\psi_2 > 0$  and  $\psi_3 = 0$ ), which from equation (11.e) implies that  $1 - m + \psi_2 = \frac{1}{1-\alpha}$ . Substituting these alternative values for  $1 - m + \psi_2$  in equation (12), and solving it for the firm's optimal investment rate yields:

$$\frac{I}{K} = \frac{1}{\alpha} \left[ \frac{1}{(1-m)} q - (1 - \tau z) \right] + \frac{h}{\alpha} \left[ \frac{\rho - (1-\tau)r}{\rho + \beta + \beta_2} \right] + n(.) \quad (13.a)$$

which is the firm's optimal investment rate when the marginal source of funds is retained earnings, and

$$\frac{I}{K} = \frac{1}{\alpha} [(1-u) q - (1 - \tau z)] + \frac{h}{\alpha} \left[ \frac{\rho - (1-\tau)r}{\rho + \beta + \beta_2} \right] + n(.) \quad (13.b)$$

which is the corresponding investment equation when the firm finances its investment at the margin through issuance of new equity.

## 2. Corporate Investment and Marginal Source of Funds

These equations offer some important insights into the relationship between the firm's optimal investment and its sources of equity financing. To highlight this relationship, it is convenient to abstract, for a moment, from the influence of debt subsidy and solve for the steady-state values of marginal  $q$  to obtain  $q^*_1 = (1-m)(1-\tau_z)$  and  $q^*_2 = \frac{(1-\tau_z)}{1-s}$ . These define, respectively, the threshold values of  $q$  for marginal investment projects that are financed by retained earnings and by issuing new equity shares. For recent values of  $m$ ,  $c$  and  $\tau_z$  from the Korean economy, it can be shown that  $q^*_2 > q^*_1$  which implies a hierarchical order in firms' financing behavior, shown in Figure 1. In this figure the horizontal lines  $S_1$  and  $S_2$  correspond respectively to  $q = q^*_1$  and  $q = q^*_2$ , and the relatively large distance between these lines reflects the combined influences of high taxation of dividend income relative to capital gains and the direct and indirect costs of issuing new share equity in Korea. This high cost differential between internal and external source of equity finance implies that only firms with relatively high marginal profitability of investment, as shown by demand schedule  $D_2$ , resort to external equity as their marginal source of funds. In contrast, firms with investment projects characterized by demand schedule  $D_1$ , rely on internal funds to finance their marginal investments. This direct relationship between firms' investment and financing decisions provides a useful device to motivate the discussion of financial policy. To the extent that firms finance their marginal investment projects through issuance of new equity shares rather than through retentions of earnings, it is the stock market performance that bears influence on the incentives to invest. On the other hand, for firms that retention of earnings is the marginal source of funds, one expects a close relationship between corporate earnings and investment. In practice, each of these scenarios may apply to some firms, but which one is predominant is the key empirical question to be addressed in the next section. Given that our



Figure 1

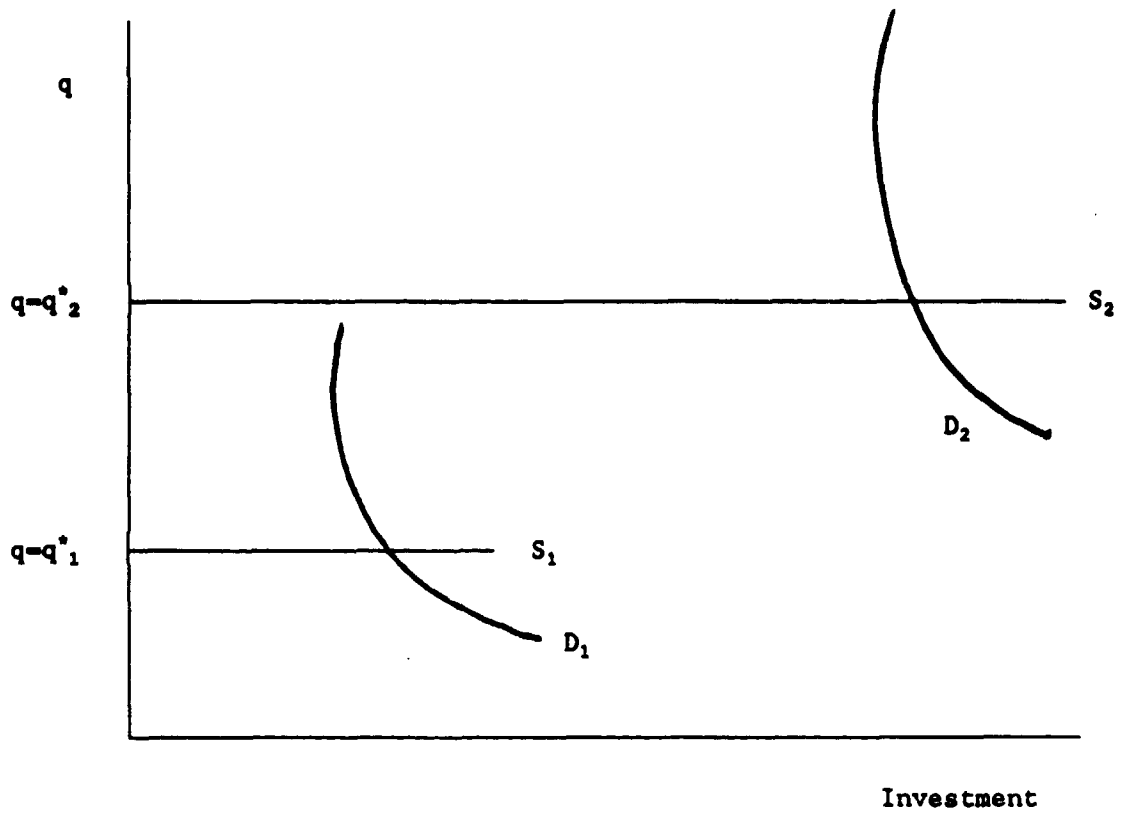


Figure 1: Marginal Source of Funds  
and Investment Schedules.

data relates to the corporate sector as a whole, we take a weighted average of equations (13.a) and (13.b) with the weight assigned to the former denoted by  $\Theta$ ; to obtain an aggregate investment equation:

$$\frac{I}{K} = \frac{1}{\alpha} \left[ \left( \frac{\Theta}{1-m} q + (1-\Theta)(1-u)q \right) - (1-\tau z) \right] + \frac{h}{\alpha} \left[ \frac{\rho - (1-\tau)r}{\rho + \beta + \beta_2} \right] + n(.) \quad (14)$$

which provides the basis for our estimation. Note that the numerical value that  $\Theta$  takes is critical to the identification of the marginal sources of funds to the corporate sector. A value of  $\Theta = 0$  implies that new share issue is the marginal source of funds; a value of  $\Theta = 1$ , on the other hand, implies that the corporate sector relies on internally generated funds to finance its marginal investment projects.

### III. Empirical Results

#### III.1. Specification and Data

In this section we use annual data for the non-financial corporate sector of the Korean economy over the period of 1963-1986 to estimate simultaneously the system of equations (14) and (4). The starting point is the modification of these equations into some suitable empirical forms. First, we specify  $n(\cdot)$ , the long-term growth in fixed capital in equation (14), as a function of the long-term growth in final demand, and distinguishing between domestic and external demand we posit:  $n(\cdot) = \eta' X_t$ , where  $\eta' = (\eta_0, \eta_1, \eta_2, \eta_3, \eta_4, \eta_5, \eta_6)$  is a vector of parameters and  $X_t' = (1, x_{1t}, x_{1t-1}, x_{1t-2}, x_{2t}, x_{2t-1}, x_{2t-2})$ , where  $x_{1t}$  and  $x_{2t}$  are, respectively, growth rates of exports and domestic demand in year  $t$ . Second, we extend equation (4) to account for the possibility that bank credit may be used to finance investments other than those in fixed assets. Thus, denoting corporate investment in financial assets by  $A_t$ , the basic equations to be estimated, expressed in discrete time, are:

$$\frac{I_t}{K_t} = \frac{1}{\alpha} \left[ \left( \frac{\theta}{1-m_t} q_t + (1-\theta)(1-u_t)q_t \right) - (1-\tau_t z_t) \right] + \frac{h}{\alpha} S_t(\beta_2) + \eta' X_t + \epsilon_{1t} \quad (15.a)$$

$$\frac{b_t}{P_t K_t} = \beta_1 + h \frac{I_t}{K_t} - \beta_2 \frac{B_{t-1}}{P_t K_t} + \beta_3 \frac{A_t}{P_t K_t} + \epsilon_{2t} \quad (15.b)$$

where all terms in equation (15.b) are scaled by PK to conform to equation (15.a),  $\epsilon_{1t}, \epsilon_{2t}$  are disturbance terms assumed to be normally distributed with definite variance - co-variance matrix and zero means, and

$$S_i(\beta_2) = \frac{\rho_i - (1 - \tau_i)r_i}{\rho_i + \bar{\beta} + \beta_2}$$

where  $\bar{\beta}$  is a given value of the rate of amortization taken to be 10 percent per year. Note that, for a given value of  $\beta_2$ ,  $S_i$  is empirically observable and thus can be used as part of the data set.

To proceed with estimation, we first obtain an unbiased estimate for  $\beta_2$  by applying instrumental variables to equation (15.b), using total corporate earnings as an instrument for investment,  $I$ . This procedure is needed to overcome the simultaneity problem associated with the appearance of investment as an independent variable in equation (15.b). Thus, using annual data from 1964 to 1986, the instrumental variable estimate of  $\beta_2$  is given by  $\hat{\beta}_2 = 0.20$  with standard error = 0.055 and  $t$  - statistic = 3.71. Given this estimate of  $\beta_2$ , we next turn to the estimation of equations (15.a) and (15.b). One obstacle, however, remains. As emphasized originally by Tobin and Brainard (1977), and subsequently by Summers (1981), Hayashi (1982), and Chirinko (1987);  $q$  in equation (15.a) is not directly observable and so this equation is not empirically operational. The standard approach adopted in the empirical work in the United States has been to use "average  $q$ " defined as the ratio of the market valuation of existing capital to its replacement cost [see, for instance, von Furstenberg (1977); Summers (1981)]. The use of average  $q$  is appealing from a theoretical point of view, since it provides a link between securities markets performance and corporate real investment behavior. The problem resides, however, with the empirical performance of average  $q$  in explaining corporate investment. The experience in the United States reveals that measures of average  $q$  are typically very poor predictors of investment, and are statistically inferior to other proxies such as the real aggregate stock market price index [Barro (1989)]. Interestingly, our findings with Korean data confirmed these findings in the United States. Experimenting with

several measures of average  $q^{11}$ , we were not able to establish any statistically meaningful relationship between corporate investment and average  $q$ . Instead, the use of real aggregate stock market price index proved to be much superior, and this provides the basis for estimation results reported below.

### III. 2. Estimation Method and Results

The system of investment equation (15.a) and the bank credit supply function (15.b) were estimated simultaneously by full information maximum likelihood method, with annual data from 1964-1986. The data has already been defined, with details regarding methodology, sources and construction being reported in the Data Appendix.

Table 1 contains the estimation results under two specifications of parameter  $\Theta$ , i.e.; (i) when  $\Theta$  was not a priori restricted; and (ii) when  $\Theta$  was restricted to be zero. The table also shows the log likelihood values under these two specifications and the implied likelihood ratio statistic for testing the hypothesis  $\Theta = 0$ . This statistic is distributed  $X^2_{(1)}$ , with critical values 3.84 (5% probability of type I error) and 6.63 (1%). Since these values exceed the computed likelihood ratio statistic of 1.902, we accept the specification  $\Theta = 0$ . This is an important finding, since it means that the corporate sector in Korea finances its investment at the margin by issuing new equity shares, rather than by resorting to earning retention. This reliance on external equity as the marginal source of funds for financing investment is consistent with the observation that investment in Korea is related to stock market price index but not to corporate earnings. The lack of strong relationship between investment and earnings implies that investment has not been constrained by internal corporate resources.

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<sup>11</sup> These measures were based on the ratio of market value of equity plus book value of debt to the replacement cost of capital, where capital was defined either broadly to include machinery, equipment, and inventories, or narrowly as only the sum of machinery and equipment.

Given the weight of evidence in support of the specification,  $\Theta = 0$ , we continue our interpretation of the results under this specification, as contained in the second column of Table 1. Regarding these results, they seem quite satisfactory, since all have the right sign and all, with the exception of second lags of growth of exports and domestic demand, are significantly different from zero at the 5 or 10 percent levels, as marked in the table. The estimated value for  $h$  is 0.43, indicating that corporations in Korea use about half of their low-cost bank loans to finance fixed investments, and use the rest to finance others such as financial investments. This estimate is consistent with supplementary information on the observed share of fixed assets in Korean corporate balance sheet and its policy implications will be elaborated below. The estimates of other financial parameters, i.e.  $\beta_1$ ,  $\beta_2$ , and  $\beta_3$  are all strongly significant, supporting the view that financial and real investment decisions are interdependent in Korea. The implied value for the coefficient of cost of adjustment is  $\alpha_2 = 22.4$ , which is high, but not unusual in the empirical literature on the Q-approach to investment.<sup>12</sup> The possibility, nevertheless, remains that our estimate may contain an upward bias due to errors in variables, or due to a specification<sup>13</sup> problem arising from our use of the aggregate real stock market price index as a proxy for the

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12 Though not directly comparable, Thirinko (1987) reports estimate for  $\alpha$  ranging from 536.62 to 558.7, when the influence of demand is included, and ranging from 183.7 to 209.6, when demand is excluded from his model of corporate investment in the United States. Similarly, estimates reported by Poterba and Summers (1983) for the United Kingdom data are much higher than our estimate for the Korean data.

13 We also experimented with the use of average rate of profits as a proxy for marginal  $q$ , but the results were not satisfactory to warrant reporting. Evidently, no single proxy can capture fully the influence on investment of marginal  $q$ . Hence, attention should be given to consideration of several proxies and indicators. The methodology for estimating multiple indicators in linear structural models is well developed [see, for instance, Joreskog and Goldberger (1975), Bentler (1983), Aigner, et. (1984) for estimation issues and Titman and Wessels (1988), for an interesting application to corporate finance]. The extension and application of this methodology to non-linear models which are typical features of the Q-approach to investment presents a promising area of future research.

theoretically appropriate, but not observable, marginal  $q$ . Finally, our results confirm the sensitivity of business corporate investment in Korea to changes in demand conditions, both internal and external. As shown in Table 1, the contemporaneous and lagged coefficients of growth rates of both real exports and domestic demand are estimated at a high level of significance, and lags of higher order do not seem to matter. Therefore, our findings lend further support to the relevance of accelerator terms in  $Q$ -models of investment behavior.

Table 1: Maximum-Likelihood Estimates of the  
Parameters of Equations (15.a) and (15.b),  
(Standard Errors are in Parentheses)

Parameter or Statistic	Unrestricted	Restricted ( $\theta = 0$ )
$\eta_0$ **/	0.12 (0.01)	0.10 (0.01)
$\alpha$ **/	32.72 (7.31)	44.79 (12.80)
$h$ */	0.56 (0.23.)	0.43 (0.24)
$\eta_1$ **	0.02 (0.02)	0.05 (0.02)
$\eta_2$ **	0.01 (0.03)	0.04 (0.02)
$\eta_3$	-0.03 (0.02)	-0.03 (0.02)
$\eta_4$ **	0.33 (0.07)	0.31 (0.07)
$\eta_5$ **	0.29 (0.06)	0.34 (0.06)
$\eta_6$	0.08 (0.05)	0.07 (0.06)
$\beta_1$ *	0.05 (0.04)	0.07 (0.04)
$\beta_3$ **	0.76 (0.17)	0.74 (0.18)
$\theta$	-0.17 (0.09)	0.00
Log L	114.865	113.914
$\sigma$	1.902	

Note: Sample period is 1964-1986; Log L represents the log likelihood statistic;  $\sigma$  is the likelihood ratio test statistic under  $\theta = 0$  hypothesis;  
 \*\*/ significant at the 5 percent level.  
 \*/ significant at the 10 percent level.



#### IV. Conclusion and Policy Implications

The econometric findings presented in this paper support three conclusions regarding the relationship between corporate finance and real investment in Korea.

First, given the premise that debt capital has been subsidized through both taxation and regulatory interest rate policy, corporations have drawn on the stock market to finance their marginal investment projects. This reliance on new share issues as the marginal source of financial capital is consistent with the observed relationship between stock market price movements and corporate investment behavior. It also accords with our inability to establish a statistically meaningful relationship between corporate investment and profits, which would have been the case had corporations funded their investment at the margin through retained earnings. This conclusion also suggests that the marginal profitability of investment in Korea is high, or has been shifting upwards. Without that, it would be difficult to justify corporate reliance on relatively costly external equity as their marginal source of funds.

Second, the real aggregate stock market price, rather than the average  $q$ , or even the average rate of profit, is the preferred proxy for the theoretically appropriate--but unobserved--marginal  $q$  in explaining corporate investment behavior. This conclusion is important, not only because it supports the findings of Barro (1989) and Fischer and Merton (1984) for the United States, but also because it draws attention to the important link between stock market and real economic activity in the Korean economy. Such a link has been particularly evident in the 1980s when the rapid growth of the market has been accompanied by a boom in corporate business investment as well as a vigorous economic growth. The 1980s have also seen other important macroeconomic and policy changes in the Korean economy including measures to reduce inflation, a

large growth in household savings and a sharp turn-around in the country's balance of payment position from deficit to surplus in 1986.<sup>14</sup> These developments highlight the macro dimension of stock market performance in Korea, and in that respect, the relationship between stock market and investment is likely to be an interactive one. Thus, our approach of treating the stock market as exogenous is likely to have introduced an upward simultaneity bias in the estimated coefficient  $\alpha$ , due to the simultaneity between stock market and corporate real investment performances.

Third, our findings highlight the extent to which corporations in Korea have used low cost debt to finance investments in financial assets, as opposed to physical and productive assets. These financial assets, referring to liquid assets (cash, bank deposits and government securities), other companies' shares and accounts receivables are known to account for a relatively larger share of corporate total assets in Korea than those in the United States or the United Kingdom. Evidence provided by Dailami (1989, b) on asset composition of corporate balance sheets in Korea and in a sample of developed countries shows, for instance, that financial assets accounted in 1983, in aggregate, for about 42.6 percent of total assets in Korea as compared with a corresponding ratio of 24.3 percent in the United States and 37.8 percent in the United Kingdom.

These conclusions, taken together, yield important implications for the conduct of financial policy in Korea. They suggest that a narrow focus on interest rate policy is likely to be ineffective, not only because of the important weight of financial assets in corporate balance sheets, but also because of the increasingly important role that the stock market has played to

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14 See Dailami (1989 a); Dornbusch and Park (1987); Corbo and Nam (1986) for review and analysis of macro economic evaluation of Korean economy in the 1980s.

supply equity capital to the corporate sector.<sup>15</sup> To the extent that external equity constitutes the marginal source of funds to the corporate sector, it is the consideration of the determinant of cost of equity such as taxation of dividends and capital gains, as well as the procedure for pricing new share issues, which are relevant in determining incentives for new investment.<sup>16</sup> In this regard, policy needs to cater increasingly to the requirement of development of equity markets, including measures to modify the prevailing method of pricing of new share issues at par rather than at market value. The existing par-value pricing procedure has evidently been an important factor behind the high cost of external equity capital in Korea and a source of unhealthy speculation.

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15 For the corporate sector as a whole, equity financing accounted during the period 1985-1987 for 23.7 percent of total corporate external financing needs, as compared to 34.4 percent from traditional bank loans.

16 There is also the argument against subsidizing debt capital that lends to distortions in resource allocation.

### Data Appendix

The primary source for most of the data used in this study is the Economic Statistics Yearbook (ESYB), Bank of Korea, various issues. Two set of flow of funds tables, i.e. the Integrated Accounts of National Income and Financial Transactions, and Financial Assets and Liabilities, contained in this publication were utilized to generate the necessary balance sheet data for the total non-financial corporate sector for the years 1963-1986. These data were supplemented, when necessary, by drawing on several other sources, including National Accounts (NA), Bank of Korea; Korean Taxation (KT), Ministry of Finance; Securities Statistics Yearbook (SSYB), Korea Stock Exchange; and Securities Market in Korea (SMK), various years, The Korea Securities Dealers Association.

The definitions of variables are as follows:

1. I = gross real investment in machinery, equipment, structures, and inventories, for non-residential, non-financial corporate sector at 1980 constant prices, based on (NA);
2. q = ratio of aggregate stock market price Index (Korea Composite Stock Price Index) to implicit price deflator for capital goods (SSYB) and (NA);
3. b = gross borrowing consisting of special and commercial bank loans, insurance and trust loans and net foreign loans, (ESYB);
4. B = total corporate debt consisting of total bank debt, foreign debt and debt owned to insurance and trust companies, (ESYB);
5. m = personal tax rate on dividend income, constructed as the weighted average of marginal personal tax rates on dividends for different class

of stock holders, i.e. individuals, institutions, and companies. The source of data is (KT) for tax rates and (SSYB) for stock ownership composition;

6.  $\rho$  = average yield on government bonds; for the 1972-1986 period and prior to that corporate dividend yield, (SSYB);
7.  $r$  = nominal lending rate, constructed as the simple average of rates on general bank loans, export loans, loans from the Machinery Industry Promotion Fund; and loans from the National Investment Fund, (NA);
8.  $\tau$  = corporate income tax rate, including defense and residence tax, (KT);
9.  $z$  = present value of standard depreciation allowances on new investment in fixed assets (machinery and equipment and structures) allowed for tax purposes and calculated under a straight-line depreciation formula and based on an asset lifetime of 42.5 years for structures and 10 years for machinery and equipment, (KT).
10.  $u$  = average cost per unit of gross proceeds from issuing new equity shares, calculated as:  $u = (UPC + tc) (RIPOS) + (1-RIPOS) (tc)$ , where  $UPC$  = underpricing cost associated with IPOS, taken from Kim and Lee (1989);  $tc$  = transaction cost, taken from (SMK);  $RIPOS$  = ratio of capital raised through IPOS relative to total capital raised by issuance of new equity shares, (SMK).
11.  $K$  = net capital stock, where capital is defined broadly to include machinery and equipment, structures and inventories; fixed assets were calculated at replacement cost value, based on perpetual inventory value, using an average depreciation rate of 0.091; and bench mark value for 1962 obtained from Pyo (1988). Inventories were measured at market value, after adjustments for inflation and inventory turnover are taken into account (NA) and (ESYB).
12.  $A$  = corporate investment in non-fixed assets, (ESYB).
13.  $x_1$  = Annual growth rate of export volume (NA).

14.  $x_2$  - Annual growth rate of real domestic demand (NA).

Table A.1

Investment, Financial and Tax Data: Korean Non-financial Corporate Sector  
(Annual Averages for Selected Periods)  
 (Percentage, unless indicated)

	1963-69	70-74	75-78	79-81	82-86
1. <u>Corporate Fixed Investment</u>					
a. growth rate	25.7	10.5	21.3	-1.1	11.7
b. percent of GDP	12.6	14.5	17.4	19.0	19.0
2. <u>Taxation of Income from Capital</u>					
a. corporate income	29.4	26.7	35.4	41.1	40.5
b. dividend income	11.3	15.8	57.4	61.6	57.6
c. income earned on interest on bank deposits	13.5	19.0	6.3	10.2	17.8
d. income earned on interest from government bonds	0	0	0	4.3	17.8
3. <u>Real Interest Rate</u>	-0.2	-5.8	-7.7	-3.5	6.4
4. <u>Stock Market</u>					
a. Market Capitalization/GDP	2.7	5.5	11.1	7.1	8.4
b. Real Aggregate Price Index(1980=100)	166.8	230.0	216.5	117.4	121.8
5. <u>Corporate Investment/Total Domestic Investment</u>	65.1	62.3	65.4	62.4	60.3

Note and Sources: See previous section on definition and source of data.

#### REFERENCES

- Abel, A. B. (1979), Investment and the Value of Capital, Garland, New York.
- \_\_\_\_\_, (1983), "Optimal Investment Under Uncertainty," The American Economic Review, pp. 228-233.
- Aigner, D., C. Hsiao, A. Kapteyn and T. Wansbeck, (1984), "Latent variable Models in Econometrics" in Z. Griliches and M. D. Intriligator, eds., Handbook of Econometrics, Vol. II, North Holland Publications, pp. 1321-1393.
- Barro, R. I., (1989), "The Stock Market and Investment," National Bureau of Economic Research, Working Paper, No. 2925.
- Bentler, P. M., (1983). "Simultaneous Equation Systems and Moment Structure Models," Journal of Econometrics, pp. 13-42.
- Bernanke, B. and M. Gertler, (1989), "Agency Costs, Net Worth, and Business Fluctuations," The American Economic Review, pp. 14-31.
- Bradley, Michael, Gregory Jarrell and E. Han Kim (1984), "On the Existence of an Optimal Capital Structure: Theory and Evidence," Journal of Finance, 39, 857-78.
- Chirinko, R. S., (1987), "Tobin's Q and Financial Policy," Journal of Monetary Economics, pp. 69-87.



- Cho, Yoon Je, (1986), "Inefficiencies from Financial Liberalization in the Absence of Well-functioning Equity Markets," Journal of Money Credit and Banking vo. 18, pp. 191-199.
- Ciccolo, J. and G. Fromm, (1979), "'q' and the Theory of Investment," Journal of Finance, May pp. 535-547.
- \_\_\_\_\_ (1980), "'q', Corporate Investment, and Balance Sheet Behavior," Journal of Money, Credit and Banking, Vol. 12, pp. 294-307.
- Coen, R. M., (1971), "The Effect of Cash Flow on the Speed of Adjustment," in Gary Fromm, ed., Tax Incentives and Capital Spending, The Brookings Institute, pp. \_\_\_\_.
- Corbo, V., and Sang-Woo Nam (1986), "The Recent Macroeconomic Evaluation of the Republic of Korea: An overview," in V. Corbo and Sang-Mok Suh, eds., Structural Adjustment in a Newly Industrialized Country: Lessons from Korea, pp. 85-141.
- Dailami, M. (1989, a) "Korea: Adjustment Progress in the 1980s," in V. Thomas, A. Chhibber, M. Dailami and J. deMelo, eds., Structural Adjustment and the World Bank, (forthcoming).
- Dailami, M. (1989, b), "Financial Market Structure and Financing of Business Investment: Issues and Policy Choices for the 1990s," unpublished, World Bank.

- DeAngelo, Harry and Ronald Masulis (1980), "Optimal Capital Structure under Corporate and Personal Taxation," Journal of Financial Economics, 8, 3-30.
- Dhrymes P. and M. Kurz, (1967), "Investment, Dividends, and External Finance Behavior of Firms," in R. Ferber, ed., Determinants of Investment Behavior, N.B.E.R., pp. \_\_\_\_\_.
- Dornbusch, R. and Y. C. Park (1987), "Korean Growth Policy." Brookings Papers on Economic Activity, No. 2, pp. 389-444.
- Fazzari, S. M., R. G. Hubbard and B. C. Petersen (1988), "Financing Constraints and Corporate Investment," Brookings Papers on Economic Activity, no. 1, pp. 141-206.
- Fischer, S. and R. C. Merton, 1984, "Macroeconomics and Finance: The Role of the Stock Market," in Essays on Macroeconomic Implications of Financial and Labor Markets and Political Processes, K. Brunner and A. H. Meltzer (eds.), Carnegie-Rochester Conference Series on Public Policy, Vol. 21 (Autumn), pp. 57-108.
- Gelb, A. (1989), "Financial Policies, Growth, and Efficiency," PPR, Working Paper, No. 202.
- \_\_\_\_\_ and P. Honohan (1989), "Financial Sector Reforms in Adjustment Programs", PPR. Working Paper, No. 169.

- Grossman, S. J. and O. D. Hart, (1982), "Corporate Financial Structure and Managerial Incentive," in J. McCall, ed., The Economics of Information and Uncertainty, University of Chicago Press, pp. 107-140.
- Gould, J. P. (1968), "Adjustment Costs in the Theory of Investment of the Firm," Review of Economic Studies, pp. 47-55.
- Greenwald, B., A. Weiss and J. E. Stiglitz (1984), "Informational Imperfections in the Capital Markets and Macroeconomic Fluctuations," American Economic Review, pp. 194-200.
- Hartman, R. (1972), "The Effects of Price and Cost Uncertainty on Investment," Journal of Economic Theory, pp. 258-266.
- Hayashi, F. (1982), "Tobin's Marginal q and Average q: a Neoclassical Interpretation," Econometrica, January, pp. 213-224.
- Jensen, M. and W. Meckling (1976), "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," Journal of Financial Economics, pp. 305-360.
- Joreskog, K. G., and A. S. Goldberger, (1975) "Estimation of a Model with Multiple Indicators and Multiple Causes of a Single Latent Variable," Journal of the American Statistical Association, pp. 631-639.
- Jorgenson, D. W. and R. E. Hall, (1971), "Application of the Theory of Optimum Capital Accumulation," in G. Fromm, ed., Tax Incentives and Capital Spending, (The Brookings Institute, Washington), pp. 9-60.

Jorgenson, D. W. (1963), "Capital Theory and Investment Behavior," American Economic Review, (May), pp. 247-259.

Kim, E. H. (1978), "A Mean-variance Theory of Optimal Capital Structure," Journal of Finance, pp. 45-64.

\_\_\_\_\_ (1982), "Miller's Equilibrium, Shareholder Leverage Clientele and Optimal Capital Structure," Journal of Finance, pp. 301-318.

\_\_\_\_\_ (1989), "Financing Korean Corporations: Evidence and Theory," in J. K. Kwon, ed., Korean Economic Development, Greenwood Press.

\_\_\_\_\_ and Lee, Young K. (1989), "Issuing Stocks in Korea," Research in Pacific-Basin Capital Markets, Elsevier Science Publisher North Holland (forthcoming).

Kraus, A. and R. Litzenberger, (1973), "A State Preference Model of Optimal Financial Leverage," Journal of Finance, pp. 911-922.

Kuh, and J. Meyer, (1963), "Investment, Liquidity and Monetary Policy," in Commission on Money and Credit: Impacts of Monetary Policy, pp. 339-474.

Lucas, R. E. (1967), "Adjustment Costs and the Theory of Supply," Journal of Political Economy 75, pp. 321-334.

\_\_\_\_\_ and E. Prescott (1971), "Investment Under Uncertainty," Econometrica, 39, pp. 659-681.

Miller, M. (1977), "Debt and Taxes," Journal of Finance, no. 32, pp. 261-275.

- Modigliani, M. and M. Miller (1958), "The Cost of Capital Corporate Finance, and the Theory of Investment," American Economic Review, no. 48, pp. 261-297.
- Myers, S. and N. Majluf (1984). "Corporate Financing and Investment Decisions When Firms Have Information Investors Do Not Have." Journal of Financial Economics 13, 187-221.
- Nabi, J. (1989), "Investment in Segmented Capital Markets," Quarterly Journal of Economics, pp. 453-462.
- Pindyck, R., (1982), "Adjustment Costs, Uncertainty and the Behavior of the Firm," American Economic Review, pp. 415-427.
- Poterba, J. and L. H. Summers, (1983) "Dividend Taxes, Corporate Investment, and Q," Journal of Public Economics, pp. 135-167.
- \_\_\_\_\_ (1985), "The Economic Effects of Dividend Taxation," in E. I. Altman and M. C. Subrahmanyam (eds.), Recent Advances in Corporate Finance, Richard D. Irwin Publication.
- Pyo, Hak-kil, (1988), Estimates of Capital Stock and Capital/Output Coefficients by Industries for the Republic of Korea, (1953-1986), Working Paper No. 8810, Korea Development Institute, Seoul, Korea.
- Ross, S. A., (1985), "Debt and Taxes and Uncertainty," Journal of Finance, pp. 637-657.

- Scott, J. H., (1976), "A Theory of Optimal Capital Structure," Bell Journal of Economics, pp. 33-54.
- Summers, L. H. (1981), "Taxation and Corporate Investment: A q Theory Approach," Brookings Papers on Economic Activity, no. 1, pp. 67-127.
- Titman, S. and R. Wessels; (1988), "The Determinants of Capital Structure Choice," The Journal of Finance, pp. 1-19.
- Tobin, J. and W. C. Brainard (1977), "Asset Markets and the Cost of Capital," in R. Nelson and B. Balassa, eds., Economic Progress, Private Value and Public Policy: Essays in Honor of William Fellner, North-Holland, Amsterdam, pp. 235-62.
- Treadway, A. B., (1967), "On Rational Entrepreneurial Behavior and the Demand for Investment," Review of Economic Studies, pp. 227-239.
- Tybout, J. R. (1984), "Interest Controls and Credit Allocation in Developing Countries," Journal of Money, Credit and Banking, pp. 474-487.
- Vickers, D. (1970), "The Cost of Capital and the Structure of the Firm," Journal of Finance, March, No. 1, pp. 35-46.
- von Furstenberg, G. (1977), "Corporate Investment: Does Market Valuation Matter in the Aggregate?" Brookings Papers on Economic Activity, No. 2, pp. 347-97.
- World Bank, (1989), World Development Report.

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